ZIW A8/2856

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Effective 10/01/2003. Patent fees are subject to annual revision.

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 620.00

Complete if Known	
Application Number	09/985,730
Filing Date	November 6, 2001
First Named Inventor	Yannick PEYSSON et al
Examiner Name	R. Raevis
Art Unit	2856
Attorney Docket No.	612.40801X00

METHOD OF PAYMENT (check all that apply)

☐ Check ☒ Credit Card ☐ Money Order ☐ Other ☐ None

☒ Deposit Account:

Deposit Account Number: 01-2135

Deposit Account Name: Antonelli, Terry, Stout & Kraus, LLP

The Director **is authorized to**: (*check all that apply*)

☐ Charge fee(s) indicated below ☒ Credit any overpayments

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FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	770	2001	385	Utility filing fee	
1002	340	2002	170	Design filing fee	
1003	530	2003	265	Plant filing fee	
1004	770	2004	385	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	

SUBTOTAL (1)

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

		Extra Claims		Fee from below		Fee Paid
Total Claims	-20**	=	x		=	
Indep. Claims	-3**	=	x		=	
Multiple Dependent					=	

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	86	2201	43	Independent claims in excess of 3
1203	290	2203	145	Multiple dependent claim, if not paid
1204	86	2204	43	** Reissue independent claims over original patent
1205	18	2205	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) $

***or number previously paid, if greater; For Reissues, see above.*

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge – late filing fee or oath	
1052	50	2052	25	Surcharge – late provisional filing fee or cover sheet	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for *ex parte* reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examination action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	420	2252	210	Extension for reply within second month	
1253	950	2253	475	Extension for reply within third month	
1254	1,480	2254	740	Extension for reply within fourth month	
1255	2,010	2255	1,005	Extension for reply within fifth month	
1401	330	2401	165	Notice of Appeal	
1402	330	2402	165	Filing a brief in support of an appeal	330.00
1403	290	2403	145	Request for oral hearing	290.00
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive – unavoidable	
1453	1,330	2453	665	Petition to revive – unintentional	
1501	1,330	2501	665	Utility issue fee (or reissue)	
1502	480	2502	240	Design issue fee	
1503	640	2503	320	Plant issue fee	
1406	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17(q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	770	2809	385	Filing a submission after final rejection (37 CFR § 1.129(a))	
1810	770	2810	385	For each additional invention to be examined (37 CFR § 1.129(b))	
1801	770	2801	385	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify) _____

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) 620.00

SUBMITTED BY		Complete (*if applicable*)			
Name (Print/Type)	Donald E. Stout	*Registration No. (Attorney/Agent)*	26,422	*Telephone*	703-312-6600
Signature	Donald E. Stout			*Date*	05/28/2004

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant(s):	Yannick PEYSSON et al
Serial No.:	09/985,730
Filed:	November 6, 2001
For:	METHOD OF DETERMINING THE THERMAL PROFILE OF A DRILLING FLUID IN A WELL
Art Unit:	2856
Examiner:	R. Raevis

APPELLANTS BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

May 28, 2004

Sir:

I. REAL PARTY IN INTEREST

The real party in interest is the Assignee, Institut Français du Pétrole of 1 & 4, Avenue De Bois Preau, 92852 Rueil-Malmaison Cedex, France.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

III. STATUS OF THE CLAIMS

Claims 1-10 have been cancelled and claims 11-46 are the subject matter of the Appeal.

IV. STATUS OF AMENDMENTS

The Examiner's Advisory Action of March 5, 2004 has refused entry of Applicants' January 28, 2004 Rule 116 Amendment. That Amendment requested an amendment to the specification to insert amendments to paragraphs [0020] and[0026] which have been refused entry for reasons which are not at this time understood by the Appellants.

As requested by the Examiner, the amendments to paragraphs [0020] and [0026] are being resubmitted but, in any event, they do not effect the Final Rejection which rejects the claims only on grounds of prior art.

V. SUMMARY OF THE INVENTION

The present invention is a method of determining a thermal profile of a drilling fluid circulating in a well during drilling. The method comprises the steps of
a) determining an expression $\theta 1$ of a thermal profile of the drilling fluid inside the drill string of radius R1 in the well and a expression $\theta 2$ of a thermal profile of the drilling fluid in an annulus of radius R2 surrounding the drill string, using a heat propagation equation accounting for a thermal profile of a medium surrounding the well;
b) measuring a temperature T1 of the drilling fluid at a well inlet, a temperature T2 at a bottom of the well, and a temperature T3 at a well outlet; and wherein c) the

expressions $\theta 1$ and $\theta 2$ meet temperature boundary conditions of T1, T2 and T3. The method permits a real-time determination of the thermal profile of the drilling fluid. See paragraph [0002] of the Substitute Specification.

The significance of the measuring points of the temperatures T1, T2 and T3 is further discussed in paragraphs [0024]-[0026] of the Substitute Specification. The invention utilizes the three measurement points of the well inlet, bottom of the well and the well outlet as the temperature boundary conditions.

VI. ISSUES

(1) Are claims 11-41 anticipated by the Hasan publication entitled "Mechanistic Model for Circulating Fluid Temperature" (hereinafter Hasan)? (2) Are claims 42-46 obvious over Hasan?

VII. GROUPING OF CLAIMS

The claims do not stand or fall as a group. Discussion of the patentability of individual claims is set forth below in Appellants' argument.

VIII. ARGUMENT

A. The Final Rejection

The March 5, 2004 Advisory Action finally rejected claims 1-41 as being anticipated by Hasan et al. Specifically, the Examiner reasoned as follows:

> Regarding claims 1, 13, 23, 26, 31, 38, 14, 27, 32, 39, 15, 33, 40, 16 and 41; Hussan teaches a method to determine temperature equations (Equations 5 and 6) of a thermal profile of a drilling fluid circulating in a well during drilling, comprising the steps of: determining an equation (equation 5) indicative of thermal profile of fluid in tubing of

a drill string in a well, and an equation (equation 6) of a thermal profile of drilling fluid in an annulus that surrounds the string, using a heat propagation equation (equation 1) for a thermal profile of a medium (note the use of "formation temperature" on p. 134, left hand col, third paragraph); and measuring temperature of the fluid at the "inlet" (Figure 11) and various well depths (Figure 12) for comparison of field data with the model. The equations generally agree with the field data to a reasonable extent, and thus the expressions meet the temperature boundary conditions.

As to claim 12, 22, 29, 35, 29, 35, 25, 36, 30, 37,see Figures 11, 12.

As to claims 21, 24, 34, 28, see Figure 10.

Furthermore, the March 5, 2004 Advisory Action finally rejected claims 42-46 as being obvious over Hasan as follows:

> As to claims 42-46, it would have been obvious to apply Husan's invention to a vertical offshore well because the extension to off shore drilling is a natural extension from on shore profile study.

B. The Rejection of Claims 1-41 on Grounds of Anticipation is Erroneous

The Examiner's Final Rejection of claims 11-41 as set forth above is erroneous for the following reasons:

Independent claim 11 defines a method of determining a thermal profile of a drilling fluid circulating in a well during drilling comprising the steps:

a) determining an expression $\theta 1$ of a thermal profile of the drilling fluid inside the drill string in the well and a expression $\theta 2$ of a thermal profile of the drilling fluid in an annulus surrounding the drill string, using a heat propagation equation accounting for a thermal profile of a medium surrounding the well;

b) measuring a temperature T1 of the drilling fluid at a well inlet, a temperature T2 at a bottom of the well, and a temperature T3 at a well outlet; and wherein

c) the expressions $\theta 1$ and $\theta 2$ meet temperature boundary conditions of T1, T2 and T3.

With the invention, the thermal profile is determined by the determining of expressions of a thermal profile of a drilling fluid inside the drill string in the well and a thermal profile of the drilling fluid in an annulus surrounding the drill string determined using a heat propagation equation accounting for a thermal profile of a medium surrounding the well. Actual temperature measurements T1 of the drilling fluid at the well inlet, temperature T2 at a bottom of the well and temperature T3 at a well outlet are made. The determined expressions meet the temperature boundary conditions of T1, T2 and T3.

Hasan provides an analytical model of a circulating fluid temperature in a tank and tubing as a function of circulation time and well depth as illustrated in Fig. 1. The Abstract in column 1, paragraph 3, of page 133, teaches "[i]n this work we present a generalized analytical model for circulating fluid temperature in both conducts, for both forward and reverse circulation cases, as a function of circulation time and well depth (emphasis added)". There is no discussion of the analytical model using any temperature measurement points with the discussion of temperature measurements being mentioned in Hasan only to evaluate the analytical model to determine how closely it agrees with actual measurements. In this regard, it is clear from the statement in column 2 of page 133 "[a]lthough direct temperature

measurements have been reported at a given depth, we cannot overemphasize the need for <u>computing the temperature profile for the entire wellbore by simulating the transient process</u>" that temperature measurements are not involved (emphasis added). Moreover, page 135, in column 2, describes equations 5 and 6 as "[n]ote that both Eqs. 5 and 6 apply <u>for computing tubing and annulus profiles</u> (emphasis added)".

Measurement of the claimed temperatures T1, T2 and T3 is <u>not</u> disclosed in Hasan. The temperature measurements which are made are not the combination of T1, T2 and T3 and further, are made to determine how closely Hasan's analytical model agrees with the temperature measurements which are used to determine how closely the analytical model agrees with actual temperature measurements. Heat transfer in the annulus and the tubing is <u>modelled in accordance with equations 5 and 6</u>. Nowhere in Hasan is there any discussion of the claimed temperature measurements nor the use thereof involving expressions $\theta 1$ and $\theta 2$ meeting the temperature boundary conditions as recited in claim 11.

Claim 11 recites the steps of determining an expression $\theta 1$ and $\theta 2$ and measuring temperatures at particular places in the well with the condition that the expressions $\theta 1$ and $\theta 2$ meet the boundary conditions. The Examiner has not demonstrated anticipation of the steps of claim 11 since Hasan pertain to analytical simulation not based on the claimed measured temperature.

The Examiner's reliance on Figs. 11 and 12 is misplaced. Fig. 11 is a comparison of measured inlet temperature as a function of time compared to the analytical model of Hasan. The use of the measured inlet temperature

data is only for the purpose of comparison of real world data to measure the performance of the analytical model versus the measured inlet temperature. There is no discussion of the use of the three measured temperature conditions. Fig. 12 is a comparison of measured data with Hasan's casing and annulus models which, to the extent that temperature measurements are involved, are for comparison purposes only which do not demonstrate anticipation involving the three measured temperatures.

With respect to the dependent claims, the Examiner refers to claims 12, 22, 25, 29, 30, 35, 36 and 37 as being met by Figures 11 and 12 without explanation and further the Examiner refers to claims 21, 24, 28 and 34 as being met by Figure 10 with explanation. The aforementioned references to Figs. 10-12 do not demonstrate anticipation of the claims since, as stated above, they do not pertain to the claimed actual measured temperature data T1, T2 and T3 in association with the expression $\theta 1$ and $\theta 2$.

Claim 12 further limits claim 11 in reciting "providing a drilling fluid having a thermal profile which is a function of the depth". It is submitted that Figs. 11 and 12 do not meet the aforementioned subject matter. Fig. 11 is a function of inlet temperature versus circulation time and is referred to as "matching inlet fluid temperature". It is submitted that this subject matter, at least with respect to Fig. 11 which represents drilling fluid circulation for one hour, does not suggest providing drilling fluid having a thermal profile which is a function of depth.

Claim 13 further limits claim 11 in reciting repeating steps b), c) and d) to obtain a real-time temperature profile. It is noted that the Examiner has not

explained anything regarding repeating of steps and has not explained where a real-time temperature profile is obtained dependent upon the repeating of the steps. It is submitted that claim 13 is not anticipated.

Claim 14 further limits claim 11 in reciting with respect to step a) that the expressions $\theta 1$ and $\theta 2$ comprise unknown constants and in step c), expressions $\theta 1$ and $\theta 2$ are made to meet the boundary temperature conditions T1, T2 and T3 by determining the unknown constants. While the Examiner refers to claim 14 in the discussion of the anticipation of claim 11 (it should be noted that the Examiner has obviously made a typographical error in referring to claim 1 which is not pending), there clearly is no disclosure in Hasan of the subject matter of claim 14.

Claim 15 further limits claim 11 in reciting in step a) a heat propagation equation accounting for at least a thermal equation of the medium surrounding the well, a flow rate of the drilling fluid and a balance of thermal exchanges undergone by the drilling fluid are used and the thermal exchanges comprise at least exchanges between ascending and descending drilling fluid. It is submitted that the Examiner's inclusion of claim 15 in the general discussion of the anticipation rejection does not demonstrate anticipation of this subject matter.

Claim 16 further limits claim 11 in step a) in reciting a heat propagation in the medium which is homogeneous on a cylinder of infinite height centered on the well is used, the cylinder comprising the drill string that guides descending drilling fluid and an annulus surrounding the drill string which guides the ascending drilling fluid. While the Examiner alludes to the subject matter of claim 16 being anticipated in

the general discussion of the anticipation rejection, it is submitted that that subject matter is not present.

Claim 17 further limits claim 11 in reciting in step a) the expressions $\theta 1$ and $\theta 2$ are each split into independent equations; and in step c) the thermal profiles and derivatives of the thermal profiles of the fluid within the drill string and in the surrounding annulus are continuous. It should be noted that the record does not even contain any discussion of the rejection of claim 17. Accordingly, Appellants submit that while the Examiner has generally referred to the subject matter of claim 17 being anticipated, that the Examiner has not demonstrated the subject matter of claim 17 is anticipated by Hasan.

Claim 18 further limits claim 11 in stating that the method is applied to a vertical offshore well wherein in step a) each expression $\theta 1$ and $\theta 2$ are split into independent equations by accounting for a thermal profile of the medium surrounding the well; and in step c) the thermal profiles and derivatives of the thermal profiles of the drilling fluid within the drill string and in the annulus surrounding the drill string are continuous. It should be noted that claim 18 has not even been discussed by the Examiner on the record in the anticipation rejection. It is submitted that the subject matter of claim 18 is not anticipated.

Claim 19 further limits claim 11 in reciting the calculation of pressure drops of the drill string fluid circulating in the well during drilling are made. Again it is noted that the subject matter of claim 19 is not even discussed on the record. It is submitted that Hasan do not disclose this subject matter.

Claim 20 further limits claim 11 in reciting a use of the method wherein calculation of hydrate formation zones in the drilling fluid during drilling are made. It

should be noted that this subject matter of claim 20 is not discussed on the record. It is submitted that the subject matter of claim 20 is not anticipated by Hasan.

Claim 21 further limits claim 12 in the same manner as claim 13 limits claim 11. The subject matter of claim 21 is not anticipated for the reasons set forth above with respect to claim 13.

Claims 22-24 respectively limit claims 12, 13 and 21 in the same manner as claim 14 limits claim 11. Claims 22-24 are not anticipated for the reasons set forth above with respect to claim 14.

Claims 25-29 further limit claims 12, 13, 14, 21 and 22 by limiting step a) with a heat propagation accounting for at least a thermal equation of the medium surrounding the well, a flow rate of the drilling fluid and a balance of thermal exchanges undergone by the drilling fluid are used and the thermal exchanges comprise at least exchanges between ascending and descending fluid. While the Examiner generally refers to Figs. 10-12, it is submitted that these figures do not disclose this subject matter.

Claims 30-36 further limit claims 12-15, 21, 22 and 25 in limiting step a) to a heat propagation equation in the medium which is homogeneous on a cylinder of infinite height centered on the well as used, the cylinder comprising a drill string that guides descending drilling fluid and an annulus surrounding the drill string which guides the ascending drilling fluid. This subject matter is not anticipated for the reasons set forth above with respect to claim 16.

Claims 37-46 further limit claims 12-19, 22 and 25 in reciting in step a) each expression $\theta 1$ and $\theta 2$ is split into independent equations by accounting for a thermal profile medium surrounding the well; and in step c) the thermal profiles and

derivatives surrounding the drill string are continuous. This subject matter is not taught by Hasan.

C. The Rejection of Claims 42-46 as Being Obvious

The Examiner has provided no reasoning in the record to demonstrate that the subject matter of claims 42-46 is obvious. As has been pointed out above, Hasan is deficient in teaching the subject matter of independent claim 11 and the claims dependent therefrom. It is submitted that the Examiner's allegation that the use of Hasan to vertical offshore well is the only difference between the subject matter of claims 42-46 and Hasan is erroneous. Claims 17, 18, 19, 22 and 25, from which claims 42-46, depend are not obvious since there is not a basis in the record why a person of ordinary skill in the art would modify Hasan to arrive at their claimed subject matter.

IX. CONCLUSION

The Examiner has not demonstrated anticipation nor obviousness of the subject matter of claims 11-46. Independent claim 11 is specific to requiring expressions $\theta 1$ and $\theta 2$ which are a thermal profile of a drill fluid inside the drill string and in the annulus surrounding the drill string in association with measurements of the temperatures T1, T2 and T.3 at the inlet, bottom of the well and the outlet and the requirement that the expressions $\theta 1$ and $\theta 2$ meet the measured temperature boundary conditions of T1, T2 and T3. Anticipation requires a demonstration that each of the limitations are met or are inherently present. It is submitted that the Examiner has not carried his burden of proof of anticipation.

Therefore, the Final Rejection of claim 11 and the dependent claims on grounds of anticipation should not be sustained. Finally, the Examiner has not demonstrated with respect to the obviousness rejection that the claimed relationships of splitting the expressions $\theta 1$ and $\theta 2$ into independent equations for accounting for a thermal profile of the medium surrounding the well and that the thermal profiles and derivatives of the thermal profiles of the drilling fluid within the string and the annulus surrounding the drill string are continuous are obvious.

An oral hearing is hereby respectfully requested.

The Appeal fee of $330 and the Oral Hearing fee of $290 is included herewith on the enclosed Credit Card Payment Form.

To the extent necessary, Applicants petition for an extension of time under 37 C.F.R. §1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (612.40801X00) and please credit any excess fees to such Deposit Account.

Respectfully submitted,

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DES:dlh

CLAIMS ON APPEAL

11. A method of determining a thermal profile of a drilling fluid circulating in a well during drilling, comprising the steps:

a) determining an expression $\theta 1$ of a thermal profile of the drilling fluid inside the drill string in the well and a expression $\theta 2$ of a thermal profile of the drilling fluid in an annulus surrounding the drill string, using a heat propagation equation accounting for a thermal profile of a medium surrounding the well;

b) measuring a temperature T1 of the drilling fluid at a well inlet, a temperature T2 at a bottom of the well, and a temperature T3 at a well outlet; and wherein

c) the expressions $\theta 1$ and $\theta 2$ meet temperature boundary conditions of T1, T2 and T3.

12. A method as claimed in claim 11 comprising, after step c):

d) providing a drilling fluid having a thermal profile which is a function of the depth.

13. A method as claimed in claim 11 wherein:

repeating steps b), c) and d) to obtain a real-time temperature profile.

14. A method as claimed in claim 11, wherein:

in step a), expressions $\theta 1$ and $\theta 2$ comprise unknown constants[,]; and

in step c), expressions $\theta 1$ and $\theta 2$ are made to meet the boundary temperature conditions T1, T2 and T3 by determining the unknown constants.

15. A method as claimed in claim 11 wherein:

in step a) a heat propagation equation accounting for at least a thermal equation of the medium surrounding the well, a flow rate of the drilling fluid and a balance of thermal exchanges undergone by the drilling fluid are used and the thermal exchanges comprise at least exchanges between ascending and descending drilling fluid.

16. A method as claimed in claim 11, wherein:

in step a) a heat propagation equation in the medium which is homogeneous on a cylinder of infinite height centered on the well is used, the cylinder comprising the drill string that guides descending drilling fluid and an annulus surrounding the drill string which guides ascending drilling fluid.

17. A method as claimed in claim 11 wherein:

in step a) expressions $\theta 1$ and $\theta 2$ are each split into independent equations; and

in step c) the thermal profiles and derivatives of the thermal profiles of the fluid within the drill string and in the surrounding annulus are continuous.

18. A method as claimed in claim 11, applied to a vertical offshore well wherein:

in step a) each expression $\theta 1$ and $\theta 2$ are split into independent equations by accounting for a thermal profile of the medium surrounding the well; and

in step c) the thermal profiles and derivatives of the thermal profiles of the drilling fluid within the drill string and in the annulus surrounding the drill string are continuous.

19. A use of the method as claimed in claim 11, wherein:

calculation of pressure drops of the drilling fluid circulating in the well during drilling are made.

20. A use of the method as claimed in claim 11, wherein:

calculation of hydrate formation zones in the drilling fluid during drilling are made.

21. A method as claimed in claim 12 wherein:

repeating steps b), c) and d) to obtain a real-time temperature profile.

22. A method as claimed in claim 12, wherein:

in step a), expressions $\theta 1$ and $\theta 2$ comprise unknown constants; and

in step c), expressions $\theta 1$ and $\theta 2$ are made to meet the boundary temperature conditions T1, T2 and T3 by determining the unknown constants.

23. A method as claimed in claim 13, wherein:

in step a), expressions $\theta 1$ and $\theta 2$ comprise unknown constants; and

in step c), expressions $\theta 1$ and $\theta 2$ are made to meet the boundary temperature conditions T1, T2 and T3 by determining the unknown constants.

24. A method as claimed in claim 21, wherein:

in step a), expressions $\theta 1$ and $\theta 2$ comprise unknown constants; and

in step c), expressions $\theta 1$ and $\theta 2$ are made to meet the boundary temperature conditions T1, T2 and T3 by determining the unknown constants.

25. A method as claimed in claim 12 wherein:

in step a) a heat propagation equation accounting for at least a thermal equation of the medium surrounding the well, a flow rate of the drilling fluid and a balance of thermal exchanges undergone by the drilling fluid are used and the thermal exchanges comprise at least exchanges between ascending and descending drilling fluid.

26. A method as claimed in claim 13 wherein:

in step a) a heat propagation equation accounting for at least a thermal equation of the medium surrounding the well, a flow rate of the drilling fluid and a balance of thermal exchanges undergone by the drilling fluid are used and the thermal exchanges comprise at least exchanges between ascending and descending drilling fluid.

27. A method as claimed in claim 14 wherein:

in step a) a heat propagation equation accounting for at least a thermal equation of the medium surrounding the well, a flow rate of the drilling fluid and a balance of thermal exchanges undergone by the drilling fluid are used and the thermal exchanges comprise at least exchanges between ascending and descending drilling fluid.

28. A method as claimed in claim 21 wherein:

in step a) a heat propagation equation accounting for at least a thermal equation of the medium surrounding the well, a flow rate of the drilling fluid and a balance of thermal exchanges undergone by the drilling fluid are used and the thermal exchanges comprise at least exchanges between ascending and descending drilling fluid.

29. A method as claimed in claim 22 wherein:

in step a) a heat propagation equation accounting for at least a thermal equation of the medium surrounding the well, a flow rate of the drilling fluid and a balance of thermal exchanges undergone by the drilling fluid are used and the thermal exchanges comprise at least exchanges between ascending and descending drilling fluid.

30. A method as claimed in claim 12, wherein:

in step a) a heat propagation equation in the medium which is homogeneous on a cylinder of infinite height centered on the well is used, the cylinder comprising the drill string that guides descending drilling fluid and an annulus surrounding the drill string which guides ascending drilling fluid.

31. A method as claimed in claim 13, wherein:

in step a) a heat propagation equation in the medium which is homogeneous on a cylinder of infinite height centered on the well is used, the cylinder comprising the drill string that guides descending drilling fluid and an annulus surrounding the drill string which guides ascending drilling fluid.

32. A method as claimed in claim 14, wherein:

in step a) a heat propagation equation in the medium which is homogeneous on a cylinder of infinite height centered on the well is used, the cylinder comprising the drill string that guides descending drilling fluid and an annulus surrounding the drill string which guides ascending drilling fluid.

33. A method as claimed in claim 15, wherein:

in step a) a heat propagation equation in the medium which is homogeneous on a cylinder of infinite height centered on the well is used, the cylinder comprising the drill string that guides descending drilling fluid and an annulus surrounding the drill string which guides ascending drilling fluid.

34. A method as claimed in claim 21, wherein:

in step a) a heat propagation equation in the medium which is homogeneous on a cylinder of infinite height centered on the well is used, the cylinder comprising the drill string that guides descending drilling fluid and an annulus surrounding the drill string which guides ascending drilling fluid.

35. A method as claimed in claim 22, wherein:

in step a) a heat propagation equation in the medium which is homogeneous on a cylinder of infinite height centered on the well is used, the cylinder comprising the drill string that guides descending drilling fluid and an annulus surrounding the drill string which guides ascending drilling fluid.

36. A method as claimed in claim 25, wherein:

in step a) a heat propagation equation in the medium which is homogeneous on a cylinder of infinite height centered on the well is used, the cylinder comprising the drill string that guides descending drilling fluid and an annulus surrounding the drill string which guides ascending drilling fluid.

37. A method as claimed in claim 12 wherein:

in step a) expressions $\theta 1$ and $\theta 2$ are each split into independent equations; and

in step c) the thermal profiles and derivatives of the thermal profiles of the fluid within the drill string and in the annulus surrounding the drill string are continuous.

38. A method as claimed in claim 13 wherein:

in step a) expressions $\theta 1$ and $\theta 2$ are each split into independent equations; and

in step c) the thermal profiles and derivatives of the thermal profiles of the fluid within the drill string and in the annulus surrounding the drill string are continuous.

39. A method as claimed in claim 14 wherein:

in step a) expressions $\theta 1$ and $\theta 2$ are each split into independent equations; and

in step c) the thermal profiles and derivatives of the thermal profiles of the fluid within the drill string and in the annulus surrounding the drill string are continuous.

40. A method as claimed in claim 15 wherein:

in step a) expressions $\theta1$ and $\theta2$ are each split into independent equations; and

in step c) the thermal profiles and derivatives of the thermal profiles of the fluid within the drill string and in the annulus surrounding the drill string are continuous.

41. A method as claimed in claim 16 wherein:

in step a) expressions $\theta1$ and $\theta2$ are each split into independent equations; and

in step c) the thermal profiles and derivatives of the thermal profiles of the fluid within the drill string and in the annulus surrounding the drill string are continuous.

42. A method as claimed in claim 17, applied to a vertical offshore well wherein:

in step a) each expression $\theta1$ and $\theta2$ are split into independent equations by accounting for a thermal profile of the medium surrounding the well; and

in step c) the thermal profiles and derivatives of the thermal profiles of the drilling fluid within the drill string and in the annulus surrounding the drill string are continuous.

43. A method as claimed in claim 18, applied to a vertical offshore well wherein:

in step a) each expression $\theta 1$ and $\theta 2$ are split into independent equations by accounting for a thermal profile of the medium surrounding the well; and

in step c) the thermal profiles and derivatives of the thermal profiles of the drilling fluid within the drill string and in the annulus surrounding the drill string are continuous.

44. A method as claimed in claim 19, applied to a vertical offshore well wherein:

in step a) each expression $\theta 1$ and $\theta 2$ are split into independent equations by accounting for a thermal profile of the medium surrounding the well; and

in step c) the thermal profiles and derivatives of the thermal profiles of the drilling fluid within the drill string and in the annulus surrounding the drill string are continuous.

45. A method as claimed in claim 22, applied to a vertical offshore well wherein:

in step a) each expression $\theta 1$ and $\theta 2$ are split into independent equations by accounting for a thermal profile of the medium surrounding the well; and

in step c) the thermal profiles and derivatives of the thermal profiles of the drilling fluid within the drill string and in the annulus surrounding the drill string are continuous.

46. A method as claimed in claim 25, applied to a vertical offshore well wherein:

in step a) each expression $\theta 1$ and $\theta 2$ are split into independent equations by accounting for a thermal profile of the medium surrounding the well; and

in step c) the thermal profiles and derivatives of the thermal profiles of the drilling fluid within the drill string and in the annulus surrounding the drill string are continuous.